

Assessment of MODIS Reflected Solar Calibration Uncertainty

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ABSTRACT

Determination of the calibration accuracy and traceability of a remote sensing instrument is a driving issue in the use of satellite data for calibration inter-comparisons and studying climate change. The Terra and Aqua MODerate Resolution Imaging Spectroradiometer (MODIS) instruments have successfully operated for more than 11 and 9 years, respectively. Twenty of the thirty six MODIS spectral bands are in the reflected solar region with center wavelengths ranging from 0.41 to 2.2 microns. MODIS reflective solar band (RSB) on-orbit calibration is reflectance based through the use of an on-board solar diffuser (SD). The calibration uncertainty requirements are $\pm 2.0\%$ for the RSB reflectance factors at sensor specified typical scene reflectances or radiances. The SD bi-directional reflectance factor (BRF) was characterized pre-launch and its on-orbit changes are tracked by an on-board solar diffuser stability monitor (SDSM). This paper provides an assessment of MODIS RSB on-orbit calibration traceability and uncertainty for its Level 1B (LIB) reflectance factors. It examines in details each of the uncertainty contributors, including those from pre-launch measurements as well as on-orbit observations. Common challenging issues and differences due to individual sensors' specific characteristics and on-orbit performance are also discussed in this paper. Guidance and recommendations are presented, based on lessons from MODIS RSB calibration uncertainty assessment, for the development of future instrument calibration and validation plans.